Testing the Effectiveness of Mnemonic Strategies in Learning and Retaining New Information

ABSTRACT:

Learning new information can sometimes be a very demanding process, especially in very intense courses such as hard sciences, which can require a lot of reading, studying, and memorization. Simply reading the large walls of text within textbooks can be overwhelming to some students. Thus, applying mnemonic strategies may help in the simplification of otherwise overwhelming information and improving knowledge retention. This study was designed to test the effectiveness of such mnemonics in the memorization and retention of information both long-term and short-term. Twenty-five students separated two different lab sections of a Human Anatomy and Physiology II course were given a mnemonic phrase each week to help them retain information. After six weeks, they were tested on the information, and given a survey. Results were compared both within each group, and between the two groups. While one group of students showed better four- to five-week-long knowledge retention after applying two mnemonic phrases in their study, they did not show any significantly better retention after one week. Comparatively, the second group showed better knowledge retention overall, regardless of whether or not they had the mnemonic devices to assist them on a certain question, and even showed generally better retention of information for which they were not given mnemonic phrases after three weeks. Despite student responses claiming the effectiveness of mnemonic phrases, the data suggests other factors, aside from simply having mnemonic phrases to assist learning, are important to knowledge retention. Even still, mnemonic triggers are designed to assist learning difficult topics. Understanding their benefits, as well as where they fall short, can assist teachers in presenting students with knowledge in a manner that may optimize learning and retaining information.

METHODS:

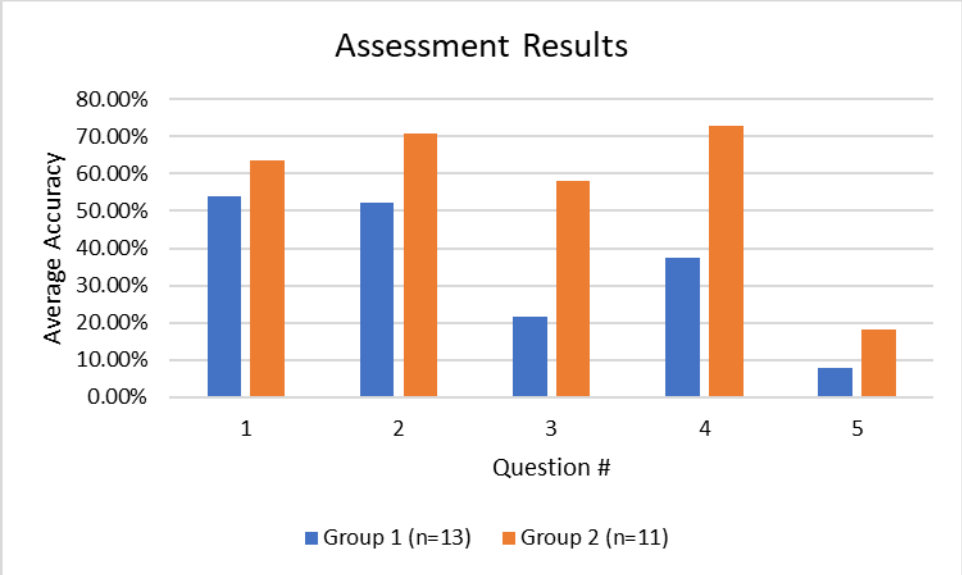
Fig 1. Weekly treatment of each group, including what information the students were given, the assisting mnemonic strategy, and the relevant exam question.

	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**
Learning Objective	Identify lung volumes and capacities on a given diagram.	Identify layers of the digestive tract on a histology	Identify the structures following the pathway of urine	Identify compensation mechanisms for acid-base	Identify structures of the male duct system following the
Assessment Information	Total Lung Capacity = Inspiratory reserve volume + Tidal volume + Expiratory	Mucosa, Submucosa, Muscularis Externa, Serosa, Adventitia	Renal pyramid -> Minor calyx -> Major calyx -> Renal pelvis -> Ureter	Respiratory: Opposite, Metabolic: Equal	Epididymis, Ductus (vas) deferens, Ejaculatory Duct, Urethra
Mnemonic Phrases	*LITER*	Medical Students Must Study Actively	Pyramids Might Make Peculiar Units	ROME	Ephie defends eager undergrads
Corresponding Exam Question	Question 1	Question 2	Question 3	Question 4	Question 5
Treated Group	Group 1	Group 1	Group 2	Group 2	Group 1

For the purposes of this study, “shorter-term” knowledge retention will refer to the final two weeks of treatment, while “longer-term” will be used to define the first three weeks. Two Human Anatomy and Physiology II lab sections consisting of twenty-five students total participated in the study. The Tuesday lab group was called “Group 1,” and consisted of fourteen students (one of which did not participate in the exam but did participate in the survey). The Thursday lab group consisting of eleven students was called “Group 2.” Each week, both lab sections were given a new unit to study (fig. 1). Though they were both given the same information, only one group each week was given a mnemonic device to assist with learning the information. Students in Group 1 were given mnemonic triggers in the first, second, and fifth week of the experiment, while those in Group 2 were given mnemonics during the third and fourth week. In the sixth and final week, students were provided an exam with questions asking information relevant to the mnemonic devices given. Each exam was scored, and the average score for each individual question was recorded. These average scores on each question were compared both within and between groups to determine the overall effectiveness of mnemonic strategies could be in retaining information over the course of the previous five weeks.

RESULTS:

Fig 2. Comparative results of each group’s average assessment scores for each question.



Group 1 (n=13) performed better on questions for which they were given mnemonic phrases than those for which they were not. One student in Group 1 did not participate in the assessment but did participate in the survey. Group 2 (n=11) scored better than Group 1 in every question,

regardless of whether or not they were given mnemonic devices. They did, however, score notably better than Group 1 on Questions 3 and 4. Both groups scored poorly on Question 5.

Fig 3A. Feedback from Group 1, based on the survey given post-exam.

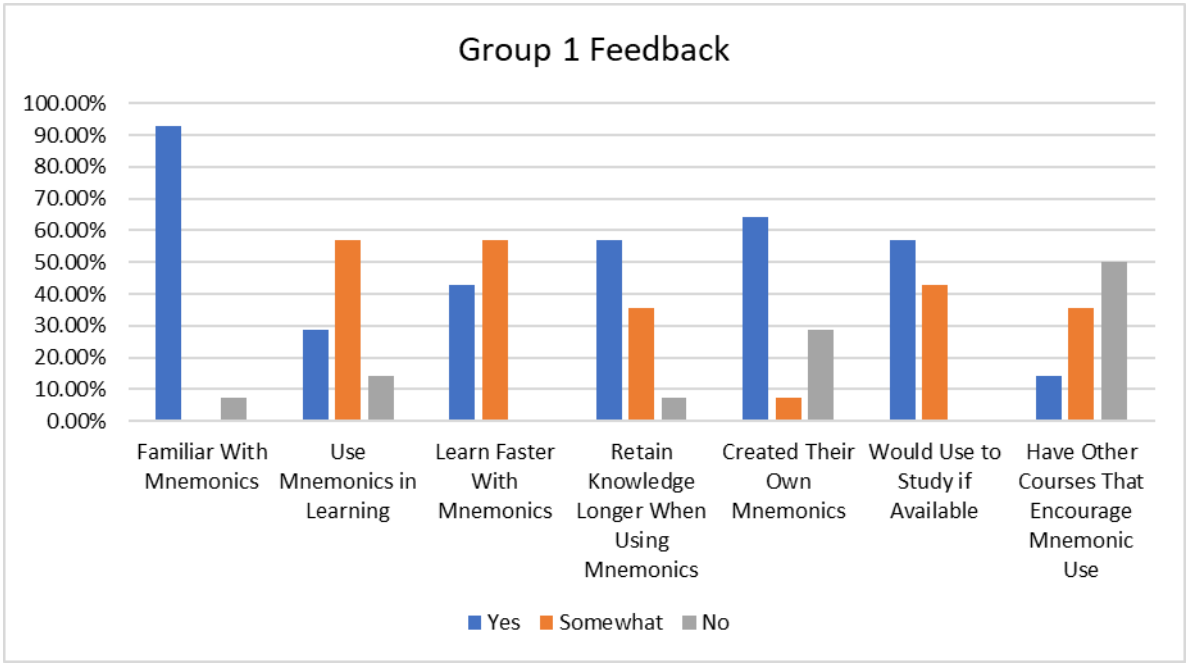
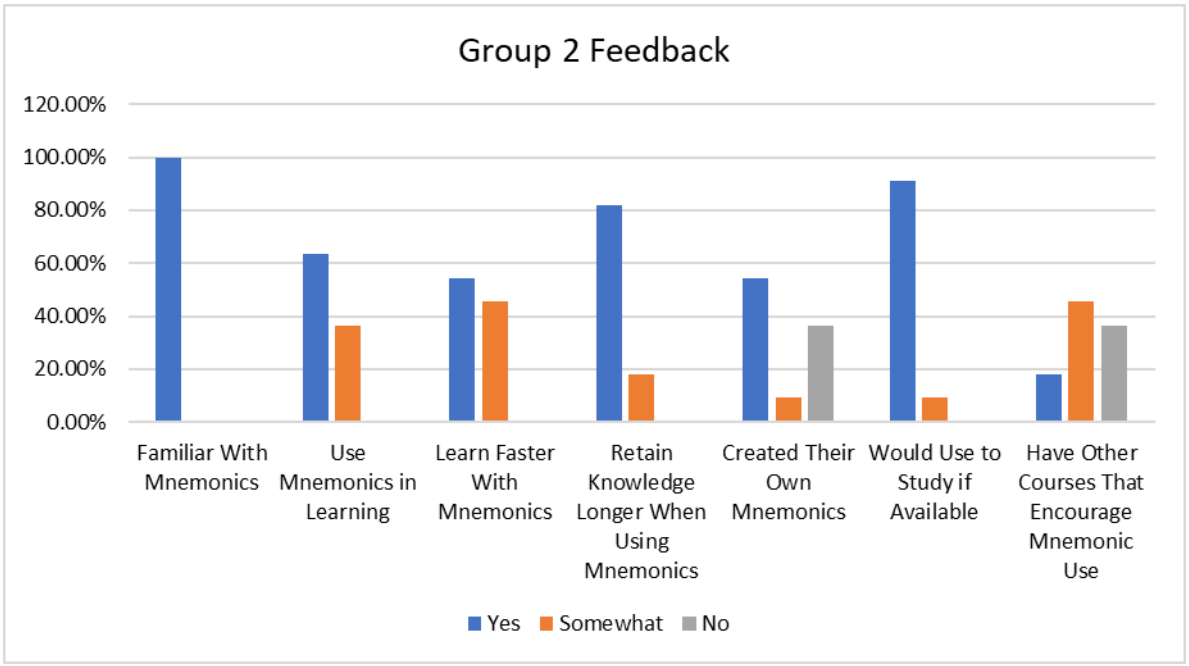


Fig 3B. Feedback from Group 2, based on the survey given post-exam.



Both groups seem to be at least somewhat familiar with mnemonic strategies and claim that they are at least somewhat effective both in learning information more quickly and retaining that information better. Both groups seem at least somewhat inclined to use them in studying when available and even making their own. The students seem to feel that their other classes do not actively encourage the use of mnemonics in studying, however.

Fig 4A. Grades of participating students.

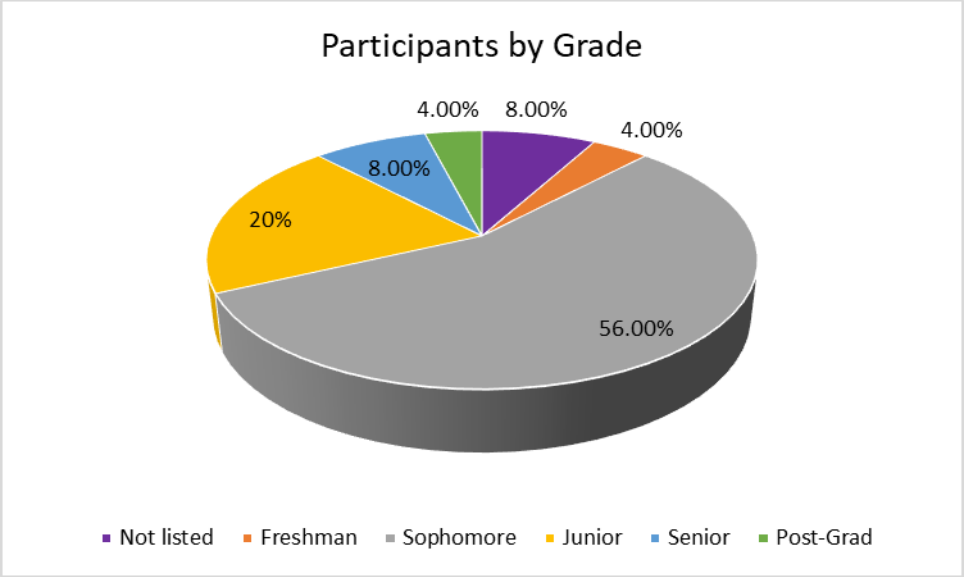
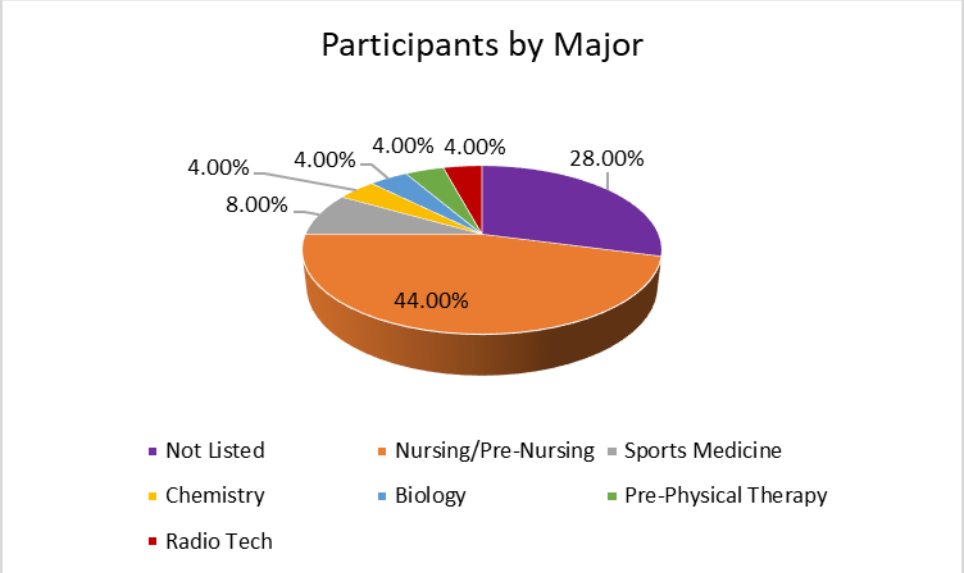


Fig 4B. Majors of participating students



Of all students across the study, most were Sophomore and Juniors. 8% of participants were seniors, and 4% were post-grad students. Only 8% of students were freshmen. Thus, most of the students in the study have a least a year of experience in college courses. Most of the students in the study plan to major in Nursing/Pre-Nursing. Aside from those not listed, the rest of the students involved are in science-based degrees, which may be demanding courses.

CONCLUSIONS:

It is difficult to ascertain the effectiveness of mnemonic strategies on shorter and longer-term retention of information from this study alone. Apart from the fifth question, Group 1 scored an average of over 50% on the first two questions, for which they were given mnemonic devices. Their performance on these two questions was significantly better than their performance on the remaining questions, suggesting that mnemonic strategies may be effective in the longer-term retention of information. However, Group 2 scored better than Group 1 on every question, regardless of whether or not they were given the mnemonic phrase to assist studying. While they scored an average of over 70% Question 4, a question for which they had a mnemonic phrase, they did not perform significantly better than they did on the other questions (barring Question 5). However, in comparison to Group 1, who had no mnemonic devices to assist them in studying the information presented in Questions 3 and 4, Group 2 scored significantly better. This could indicate that mnemonic phrases are, in fact, effective in retaining information shorter-term, but when compared to how Group 1 performed on the fifth question, it is difficult to draw such a conclusion. It is possible that the fifth question is an outlier, as both groups performed very poorly on it. Perhaps the question was not worded clearly, causing the students to perform poorly.

As for why Group 2 performed better than Group 1, regardless of mnemonic assistance, it is possible that Group 2 merely consisted of students who were more skilled at the subject matter than Group 1. Or perhaps Group 2 compensated for the lack of a mnemonic phrase by studying the information from the weeks they were not given mnemonic phrases more diligently. After all, there are other techniques studying techniques outside of mnemonic strategies. Hintzman (1976), for example, demonstrates the effectiveness of repetition in learning. However, the most likely reason for such disparity in scores is sample bias. Only twenty-four students total participated in the study, which may have provided a poor example of the effectiveness of mnemonic strategies as a whole. Thus, if the experiment were repeated, a larger sample size would provide greater insight.

Additionally, this study focused on linguistic mnemonics, which associate information with keywords or phrases. However, there are four other different types of mnemonic strategies, according to Thompson (1987, as cited by Amiryousefi and Ketabi, 2011). Spatial mnemonics associate information with a particular point in space, such as a location or a finger. Verbal mnemonics link the information into a narrative or story. Physical mnemonics involve movement and physical responses associated with the information. But in the setting of this study, a more visual approach may have been more effective. Visual mnemonics associate the information with an image or pictograph, which, in an anatomy classroom, may be helpful for learning information.

Being able to visualize certain pathways, or having an image for reference when studying, could perhaps increase a student's ability to retain the information than a simple phrase or keyword alone. Thus, a variety of mnemonic strategies should be tested in future experiments in order to better understand where one form of mnemonic may be more applicable than another.

However, there are other factors that affect the learning process beyond different types of mnemonic devices. For example, a person's emotional state (Tyng et al., 2017) can have a major impact on a person's attention, and by extension, his or her ability to properly learn or retain information. It is possible that certain students participating in this study may have been in a poor mental state. The exam was given late into the semester, and as such, students may have been more concerned about lab exams, final exams, or any number of additional projects that may be due by the end of the semester. This potentially worried or frantic state may have affected the students' performance on the assessment portion of the study and may have even affected their ability to recall information they had learned. This could potentially explain why Group 1 performed worse than Group 2 on the questions for which they were given mnemonics. It could be possible that the students of Group 1 had trouble performing under pressure compared to those in Group 2.

When asked if mnemonic strategies were effective in learning and retaining information, both groups tended to believe that they were, in fact, effective. Other studies, such as Maghy's experiment (2015), showed that mnemonic strategies were beneficial in helping students score better than a normal lecture method. Another experiment by Mastropieri, Scruggs, & Levin (1985) demonstrated that mnemonics can be very effective for retaining information in both higher- and lower-achieving students with learning disabilities, and even in those without disabilities. Though the results of this study do not entirely align with prior studies, there was some indication that mnemonic devices could be beneficial, setting a precedent for further research into the topic. By further studying mnemonics, how effective they are for retaining information long-term and short-term, and perhaps where and when they may be less effective, one could potentially optimize the learning experience and improve student performance. For this reason, it would be beneficial to continue studying the effectiveness of mnemonic strategies.

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